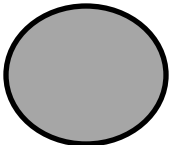
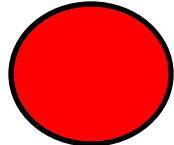
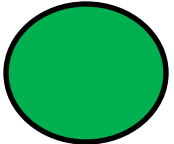
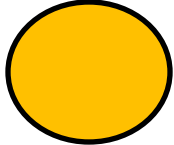


Monday, 25 September 2023

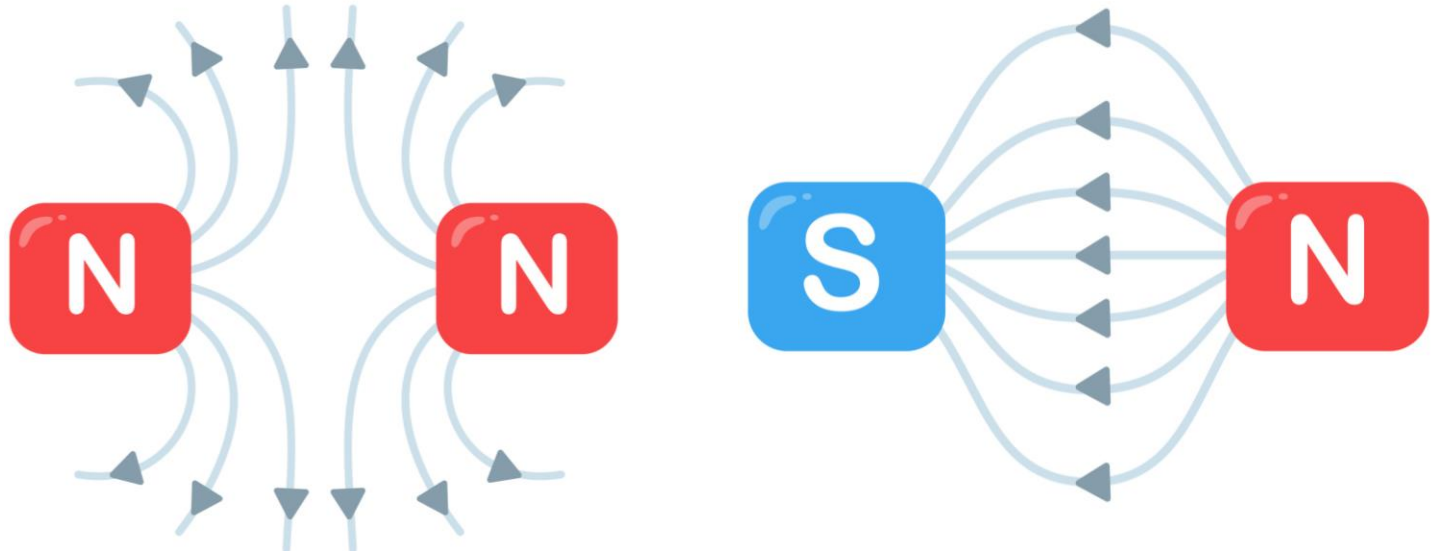
Magnetism and Electromagnetism Revision Session

-  or  Content you will **NOT** be assessed on
-  Content you **WILL** be assessed on
-  Content you **COULD** be assessed on that may get a mark or two

7.1.1 Poles of a Magnet

Think
Pair
Share

What are the poles of a magnet?



Key Term	Definition
Magnet Poles	

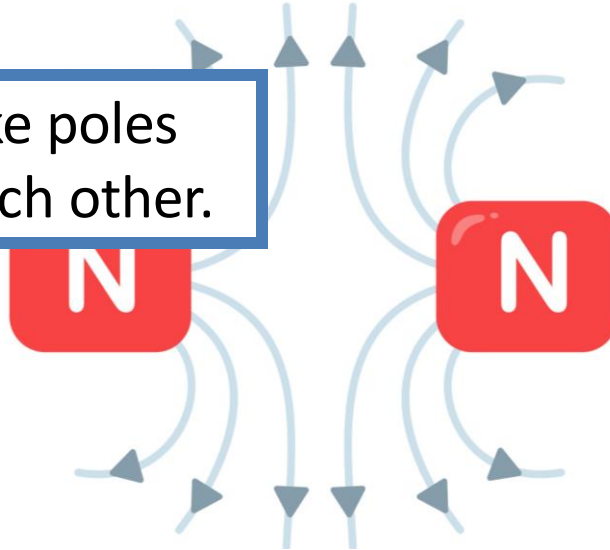


7.1.1 Poles of a Magnet

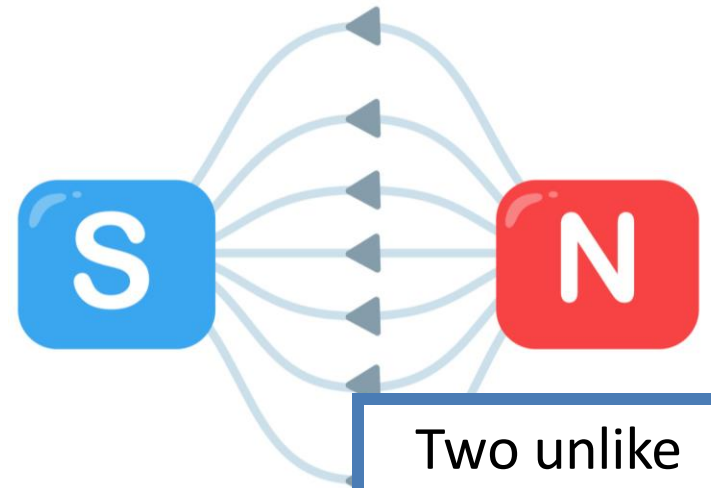
Think
Pair
Share

What are the poles of a magnet?

Two like poles repel each other.



Two unlike poles attract each other.



When two magnets are brought close together they exert a force on each other.

Attraction and repulsion between two magnetic poles are examples of non-contact force.



7.1.1 Poles of a Magnet

Think

Pair

Share

What are permanent and induced magnets?

Induced magnetism always causes a force of attraction.

When removed from the magnetic field an induced magnet loses most/all of its magnetism quickly.

Permanent magnets do not lose their magnetism.

Key Term	Definition
Permanent Magnet	
Induced Magnet	



7.1.2 Magnetic Fields

Think

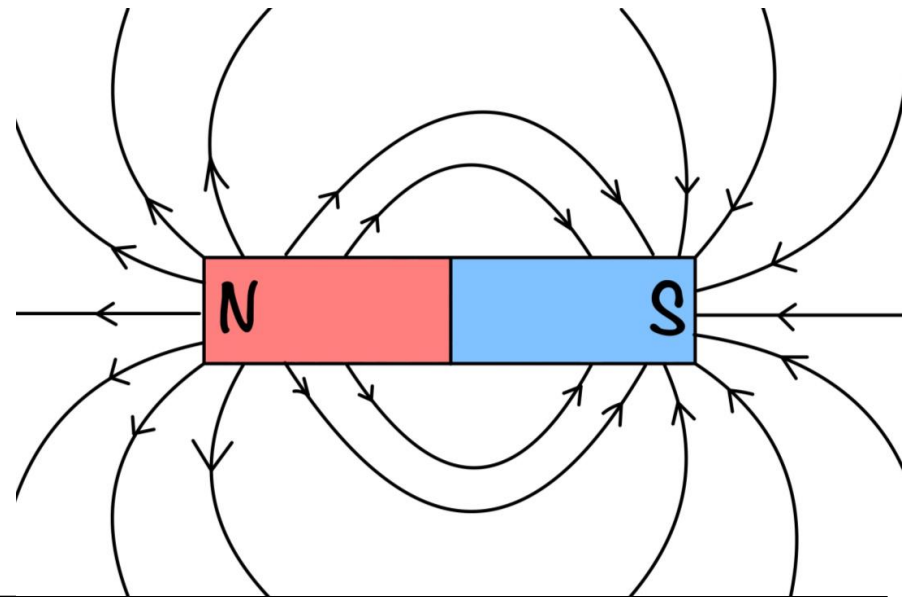
Pair

Share

What is a magnetic field?

Iron, steel, cobalt and nickel are magnetic materials.

The force between a magnet and a magnetic material is always one of attraction.



Key Term	Definition
Magnetic Field	



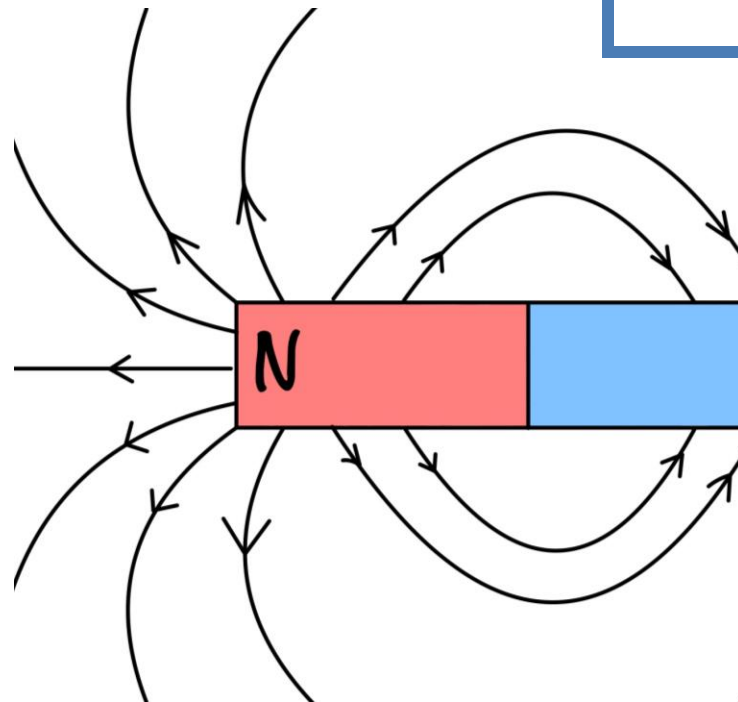
7.1.2 Magnetic Fields

Think

Pair

Share

What is a magnetic field?



The strength of the magnetic field depends on the distance from the magnet.

The direction of the magnetic field at any point is given by the direction of the force that would act on another north pole placed at that point.

The direction of a magnetic field line is from the north (seeking) pole of a magnet to the south (seeking) pole of the magnet.



7.1.2 Magnetic Fields

Think

Pair

Share

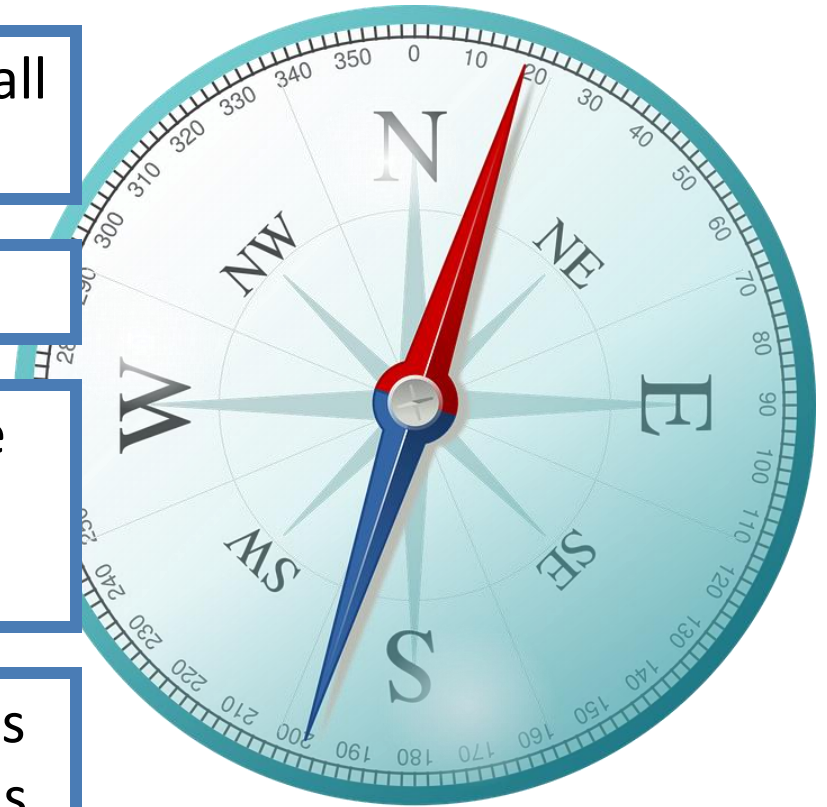
What is a magnetic field?

A magnetic compass contains a small bar magnet.

The Earth has a magnetic field.

The compass needle points in the direction of the Earth's magnetic field.

The behaviour of a compass proves the Earth has a magnetic field. This means it must have a magnetic core.



CS/F

CS/H

SS/F

SS/H

7.1.2 Magnetic Fields

Think
Pair
Share

How can we plot a magnetic field of a magnet?

1

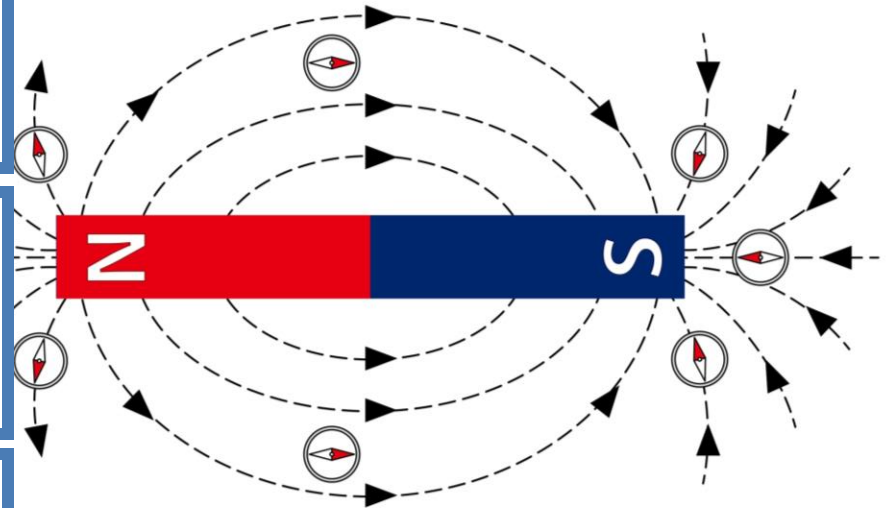
Place the magnet on a piece of paper and draw around it.

2

Mark the north and south poles.

3

Place the compass by a pole of the magnet.



CS/F

CS/H

SS/F

SS/H

7.1.2 Magnetic Fields

Think
Pair
Share

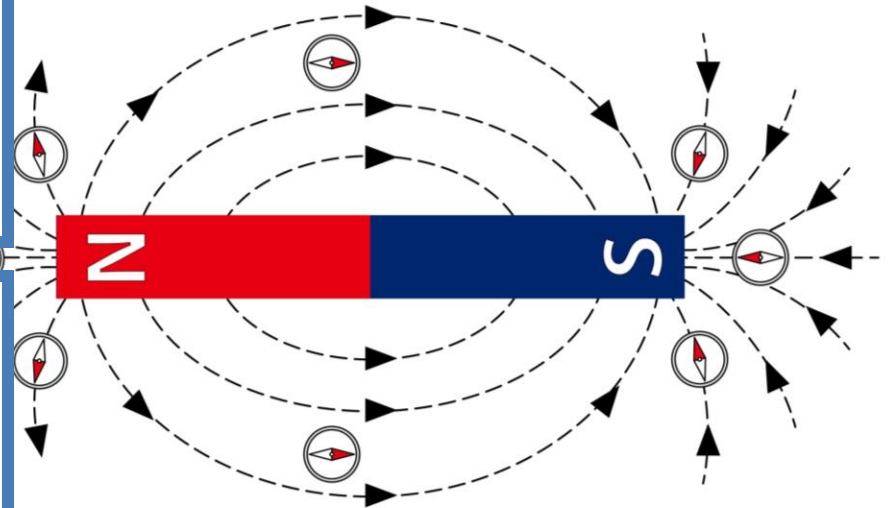
How can we plot a magnetic field of a magnet?

4

Make a dot at the tip of the compass needle and then move the compass tail to this dot.

5

Make another dot at the tip and repeat until the compass reaches the other pole of the magnet.



7.1.2 Magnetic Fields

Think
Pair
Share

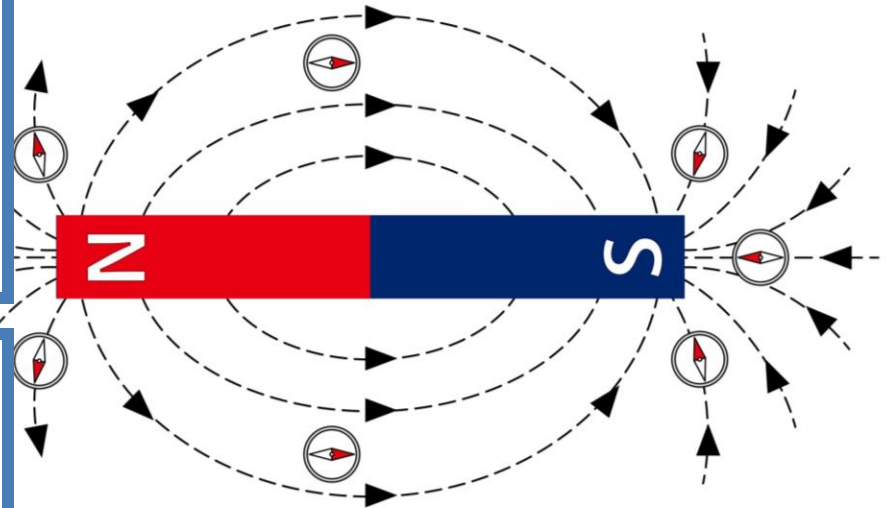
How can we plot a magnetic field of a magnet?

6

Draw a line through the dots and add an arrow to show the direction of the field line.

7

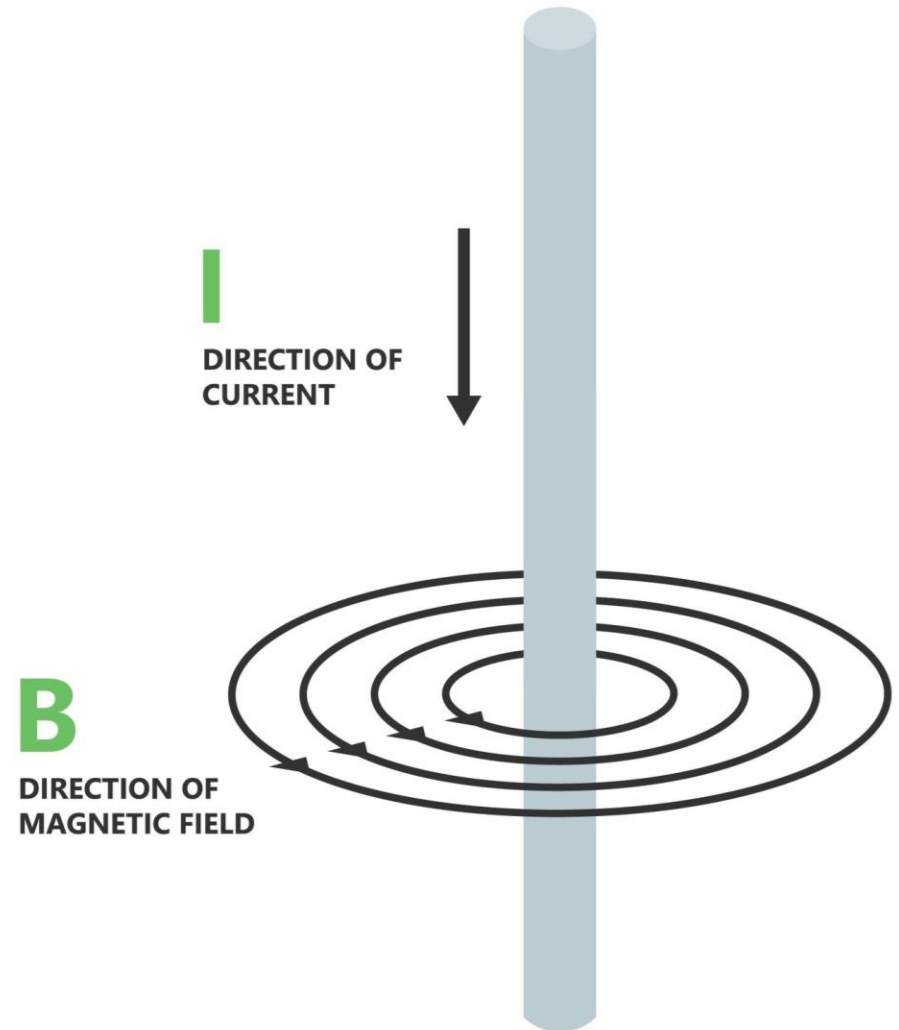
Repeat for different starting positions at the poles.



7.2.1 Electromagnetism

When a current flows through a conducting wire a magnetic field is produced around the wire.

The strength of the magnetic field depends on the current through the wire and the distance from the wire.



7.2.1 Electromagnetism

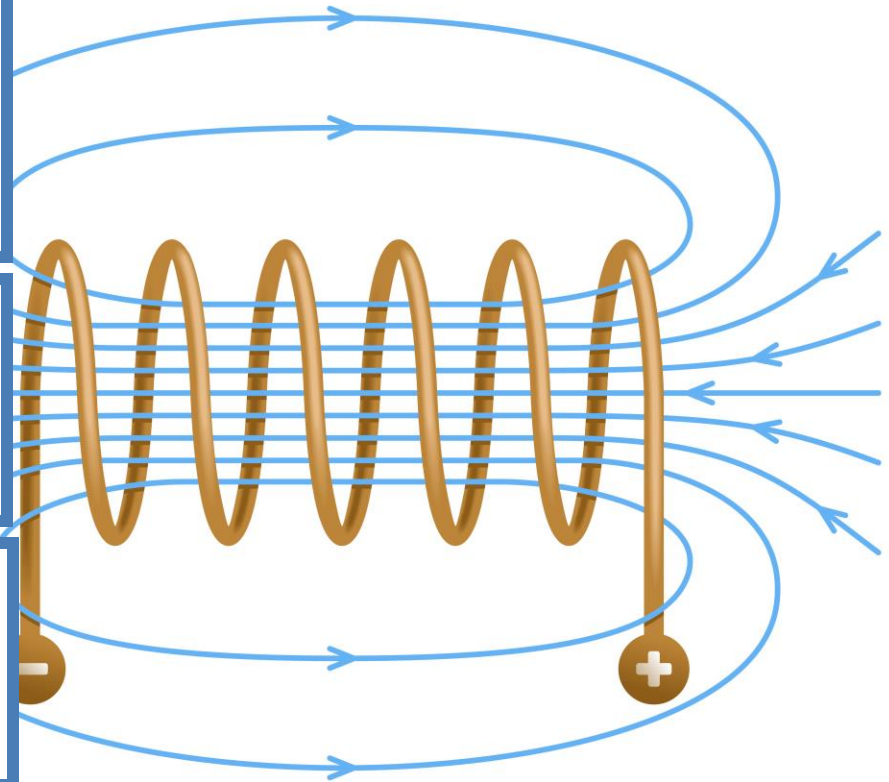
An electromagnet is a solenoid with an iron core.

Shaping a wire to form a solenoid increases the strength of the magnetic field created by a current through the wire.

The magnetic field inside a solenoid is strong and uniform.

The magnetic field around a solenoid has a similar shape to that of a bar magnet.

Adding an iron core increases the strength of the magnetic field of a solenoid.



7.2.2 Flemings Left Hand Rule

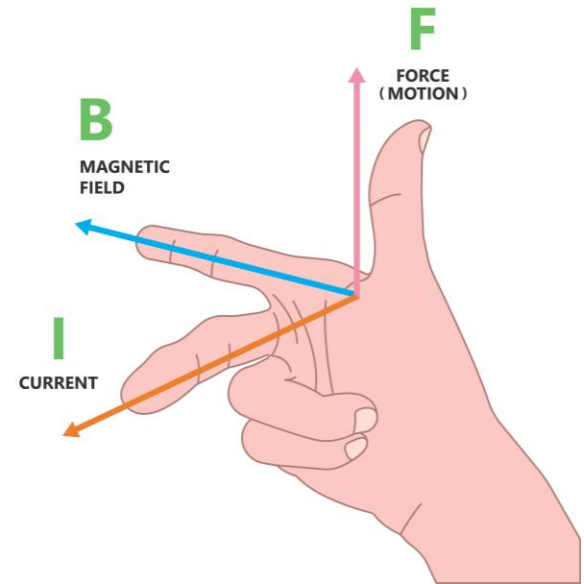
Think

Pair

Share

What is the motor effect?

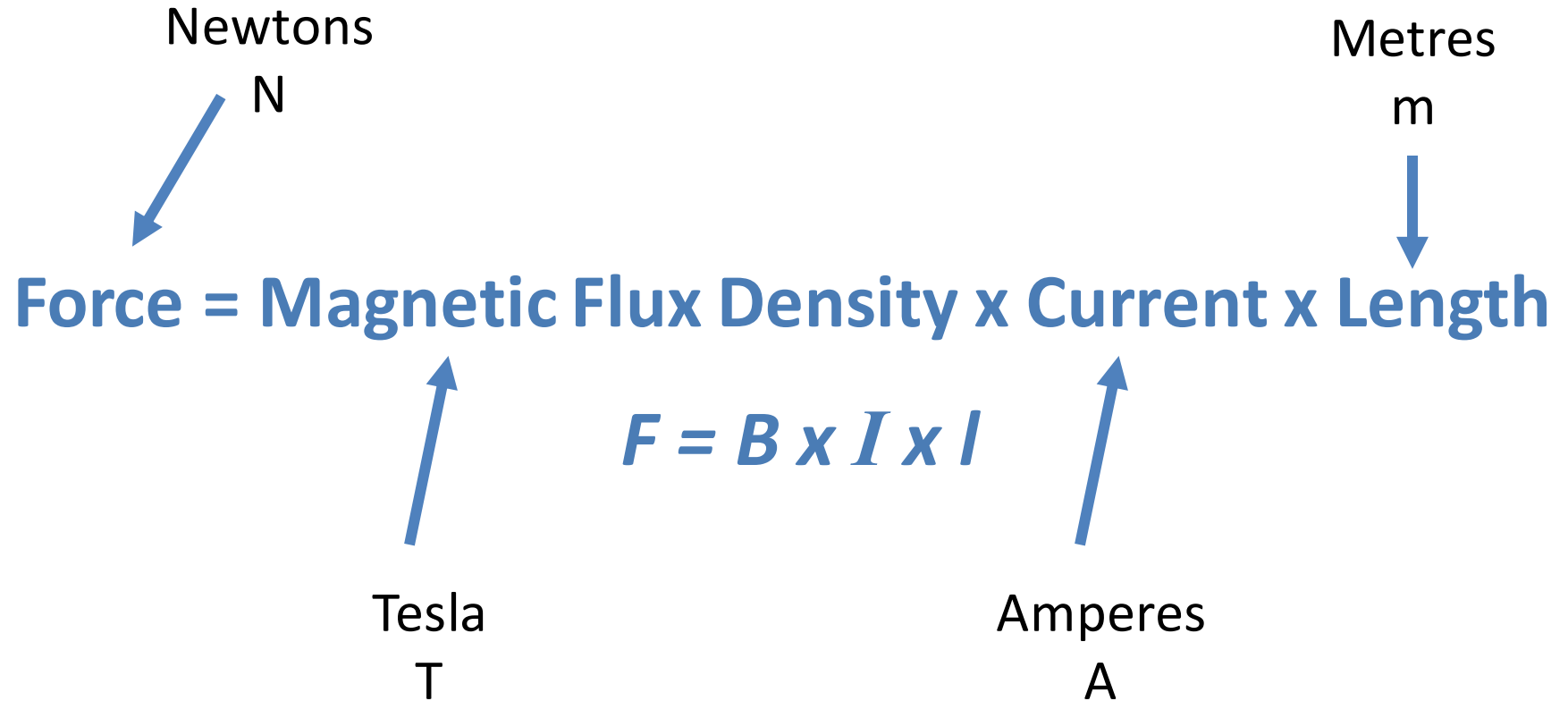
Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field.



Key Term	Definition
Motor Effect	



7.2.2 Flemings Left Hand Rule



7.2.3 Electric Motors

Think

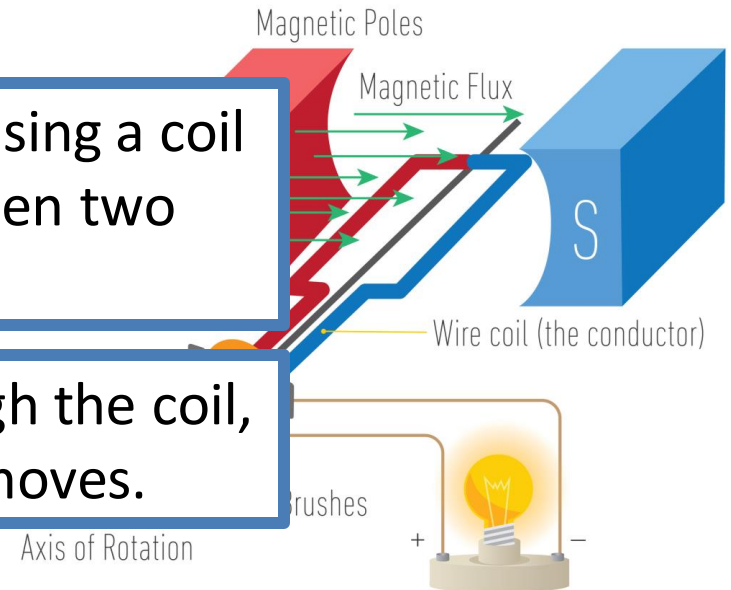
Pair

Share

How does an electric motor work?

A simple electric motor can be built using a coil of wire that is free to rotate between two opposite magnetic poles.

When an electric current flows through the coil, the coil experiences a force and moves.



Key Term	Definition
Electric Motor	

CS/F

CS/H

SS/F

SS/H

7.2.4 Loudspeakers

Think
Pair
Share

How do loudspeakers and headphones work?



Loudspeakers and headphones use the motor effect to convert variations in current in electrical circuits to the pressure variations in sound waves.

CS/F

CS/H

SS/F

SS/H

7.2.4 Loudspeakers

Think
Pair
Share

How do loudspeakers and headphones work?

The current in the electrical circuit is varying and passes through the coil.

The coil experiences a force.

The varying current causes the coil to vibrate

The coil causes the cone to vibrate.

The vibrating cone causes air molecules to move

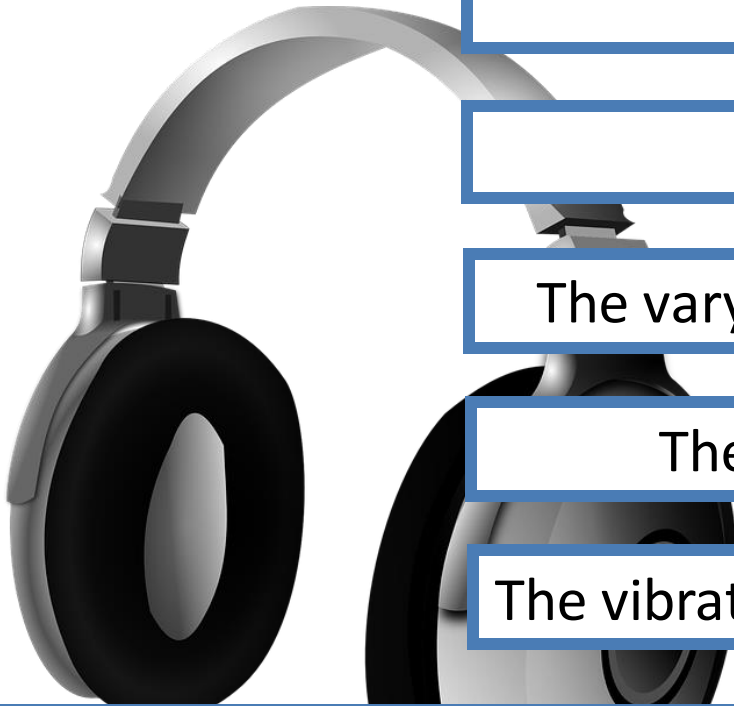
The movement of the air molecules produces the pressure variations in the air needed for a sound wave.

CS/F

CS/H

SS/F

SS/H



7.3.1 Induced Potential

Think

Pair

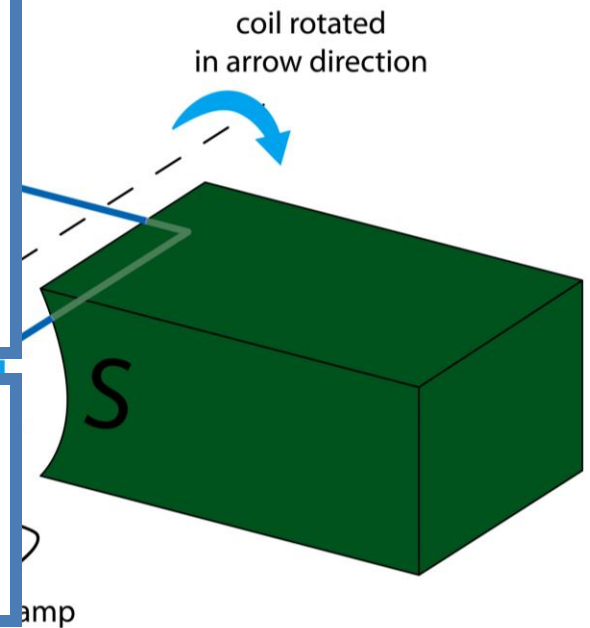
Share

How does the generator effect occur?

If an electrical conductor moves relative to a magnetic field or if there is a change in the magnetic field around a conductor, a potential difference is induced across the ends of the conductor.

If the conductor is part of a complete circuit, a current is induced in the conductor.

This is called the generator effect.



CS/F

CS/H

SS/F

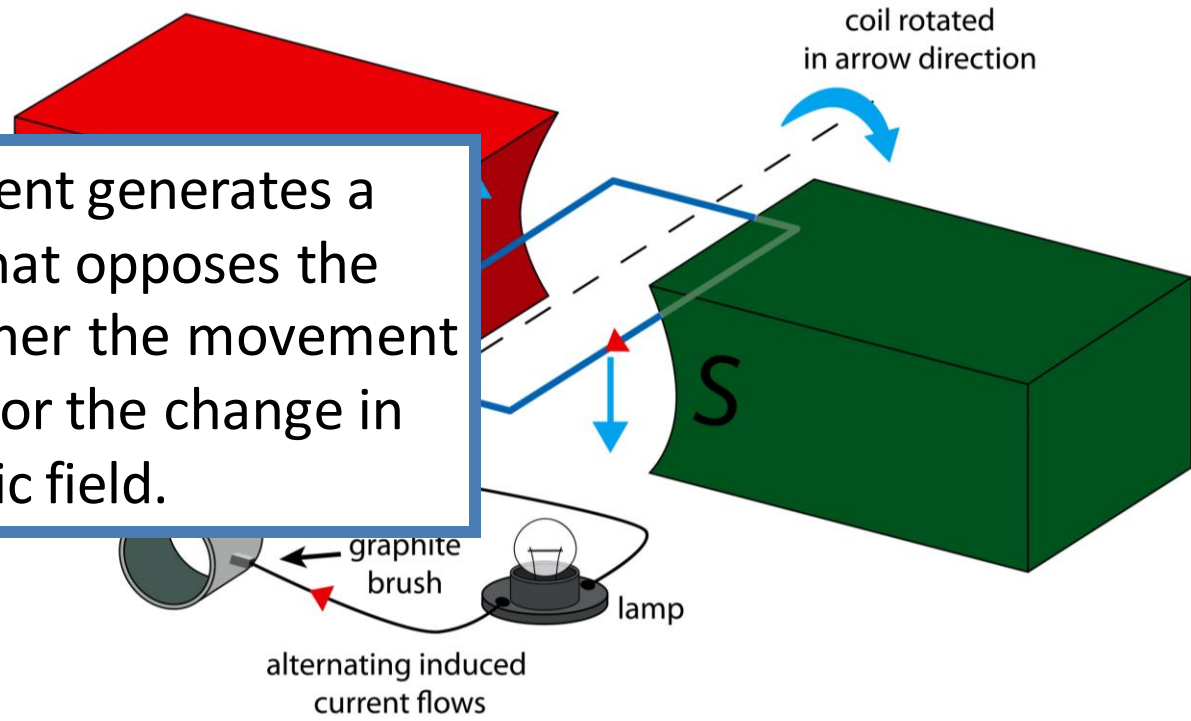
SS/H

7.3.1 Induced Potential

Think
Pair
Share

How does the generator effect occur?

An induced current generates a magnetic field that opposes the original change, either the movement of the conductor or the change in magnetic field.



7.3.1 Induced Potential

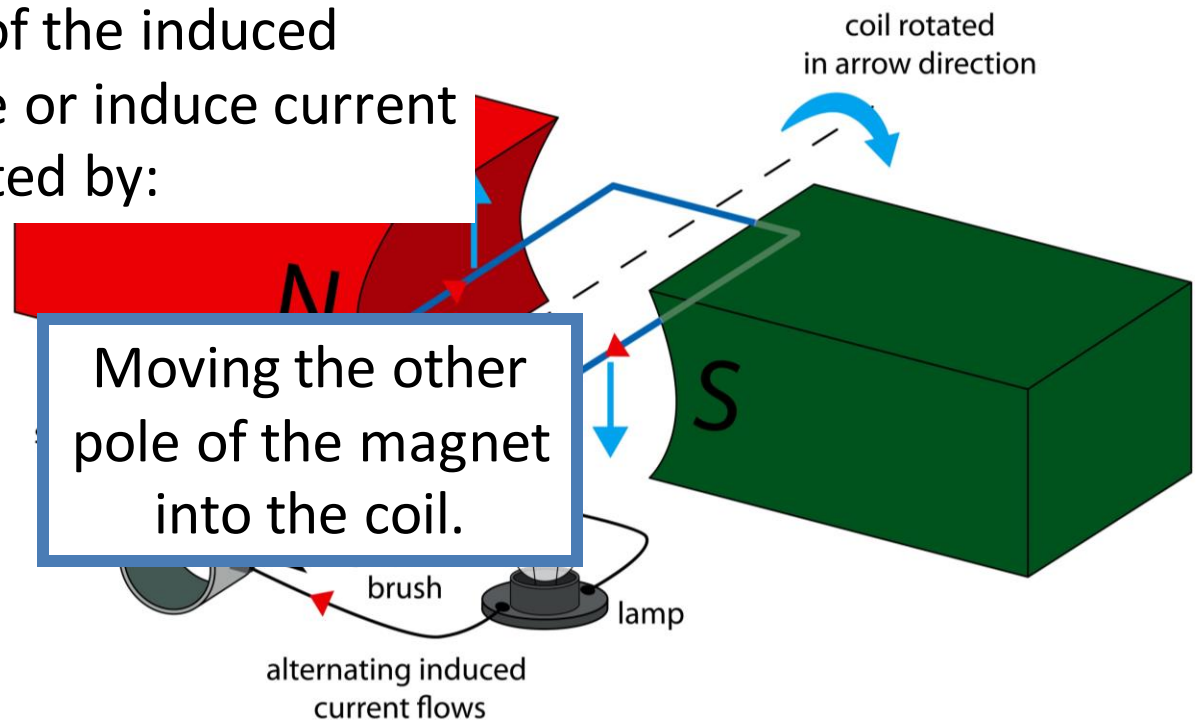
Think
Pair
Share

What affects the direction of the induced potential difference or current?

The direction of the induced potential difference or induced current is affected by:

Moving the magnet out of the coil.

Moving the other pole of the magnet into the coil.

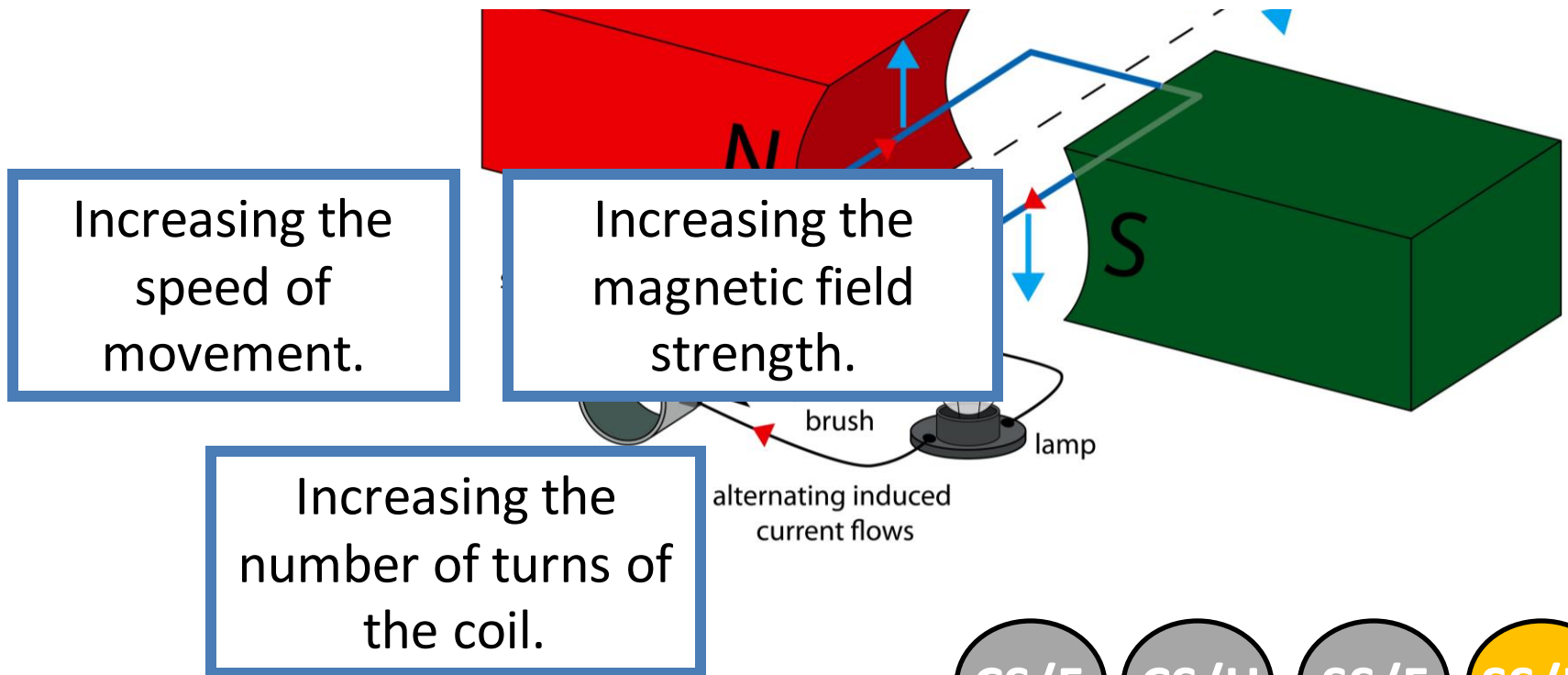


7.3.1 Induced Potential

Think
Pair
Share

What affects the **size** of the induced potential difference or current?

The size of the induced potential difference or induce current is increased by:



CS/F

CS/H

SS/F

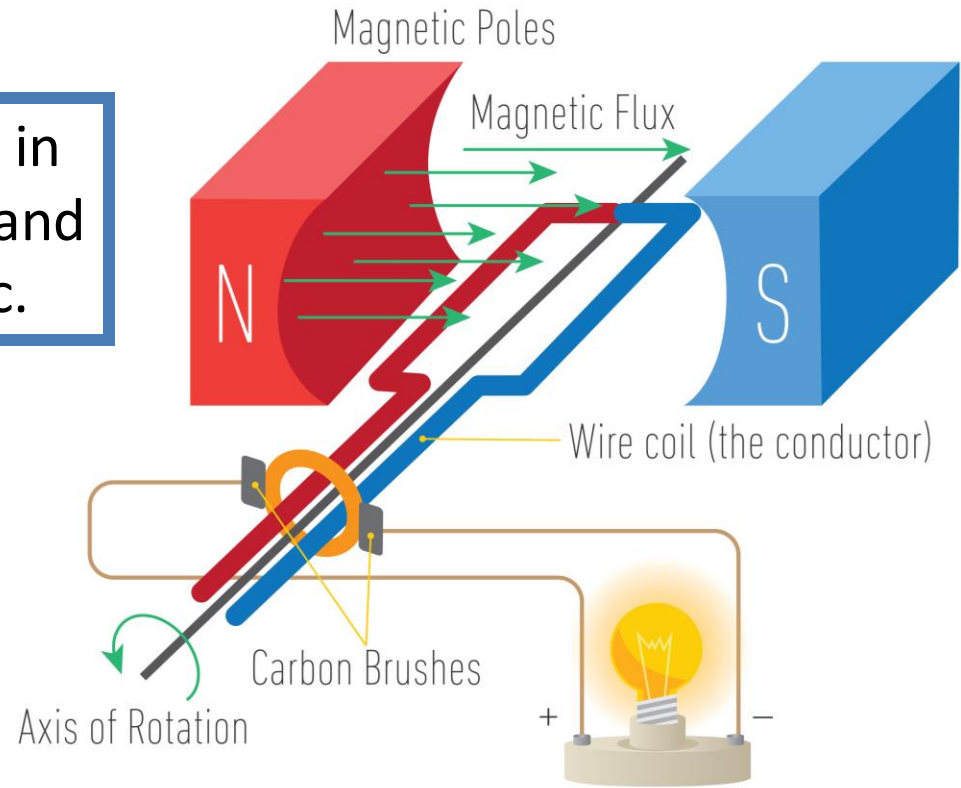
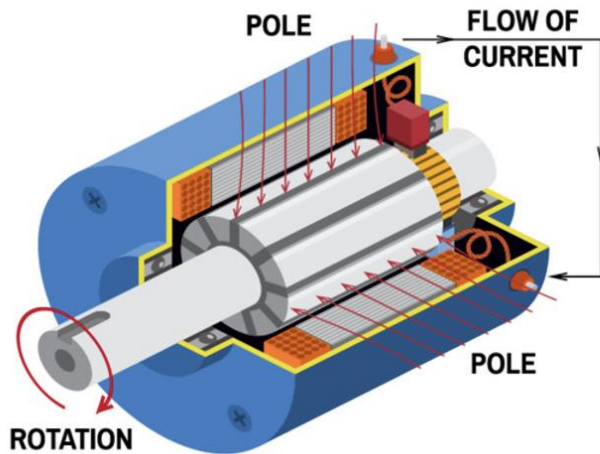
SS/H

7.3.2 Uses of Generator Effect

Think
Pair
Share

How can we generate alternating current?

The generator effect is used in an alternator to generate ac and in a dynamo to generate dc.



- CS/F
- CS/H
- SS/F
- SS/H

7.3.2 Uses of Generator Effect

Think
Pair
Share

How can we generate alternating current?

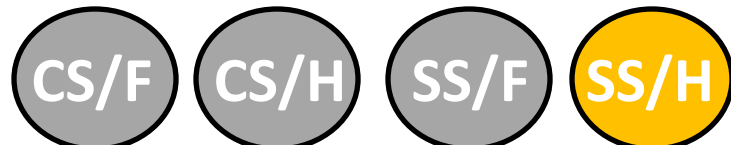
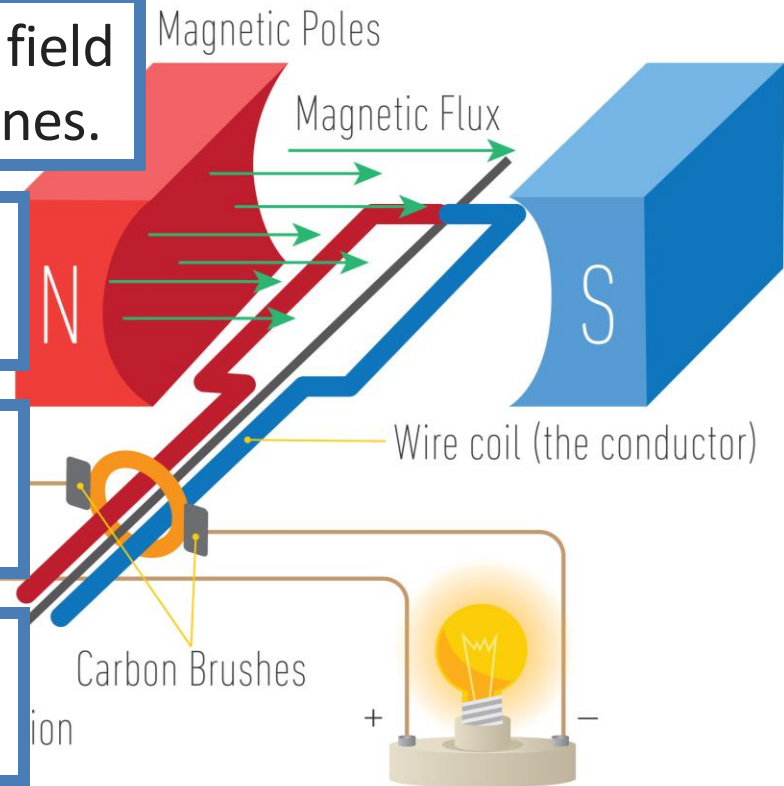
The coil moves through the magnetic field and the coil cuts the magnetic field lines.

A potential difference is induced across the coil

There is a complete circuit, so a current is induced in the coil.

Every half turn the potential difference reverses direction

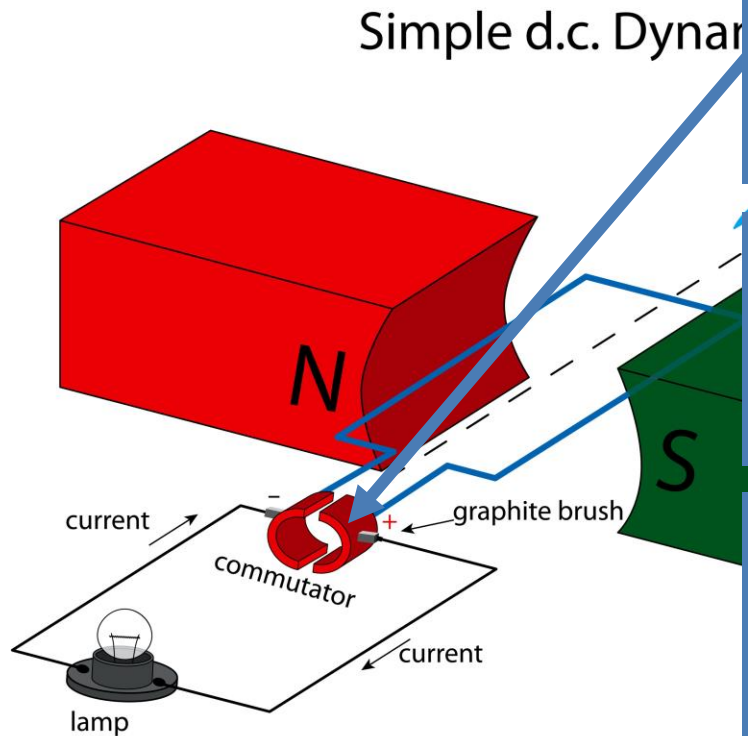
So every half turn the current changes direction.



7.3.2 Uses of Generator Effect

Think
Pair
Share

How can we generate direct current?



In a dynamo, a split ring commutator changes the coil connections every half turn.

As the induced potential difference is about to change direction, the connections are reversed.

This means that the current to the external circuit always flows in the same direction.

A dynamo can be used to generate a direct current.



7.3.3 Microphone

Think

Pair

Share

How do microphones work?



Microphones use the generator effect to convert the pressure variations in sound waves into variations in current in electrical circuits.

Sound waves cause the diaphragm to vibrate.

The diaphragm causes the wire to vibrate.

The wire moves through the magnetic field.

A potential difference is induced.

CS/F

CS/H

SS/F

SS/H

7.3.4 Transformers

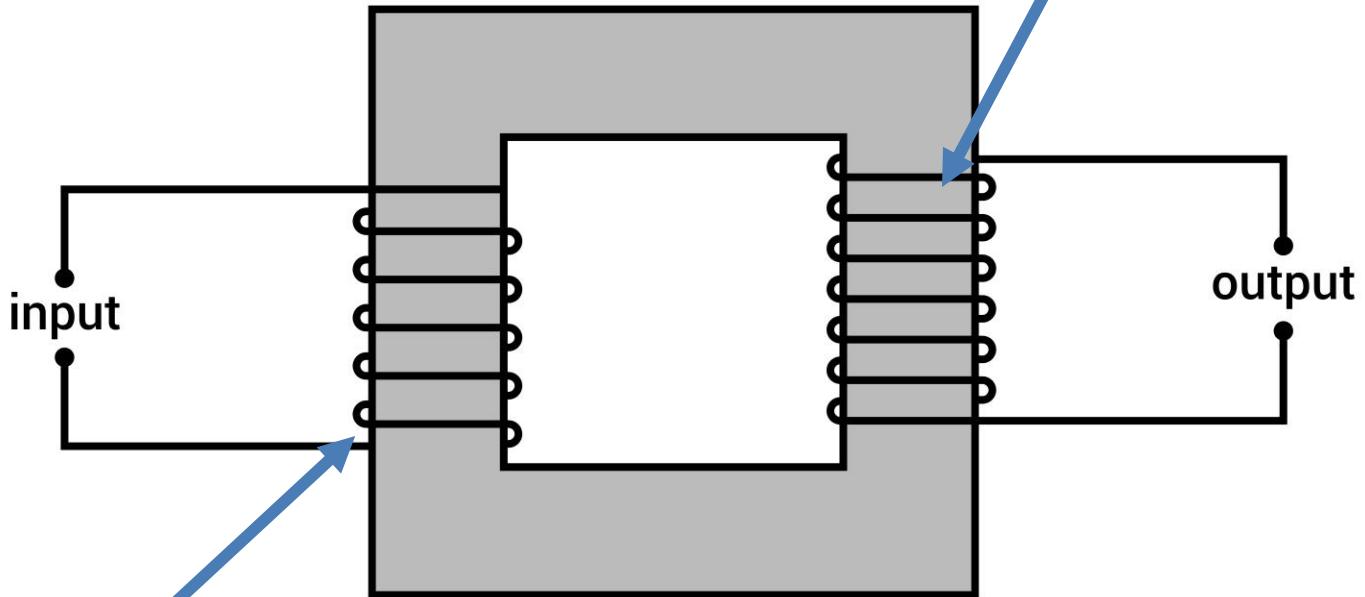
Think
Pair
Share

What are transformers?

A basic transformer consists of:

..and a secondary coil wound on an iron core.

Iron is used as it is easily magnetised.



A primary coil...

- CS/F
- CS/H
- SS/F
- SS/H**

7.3.4 Transformers

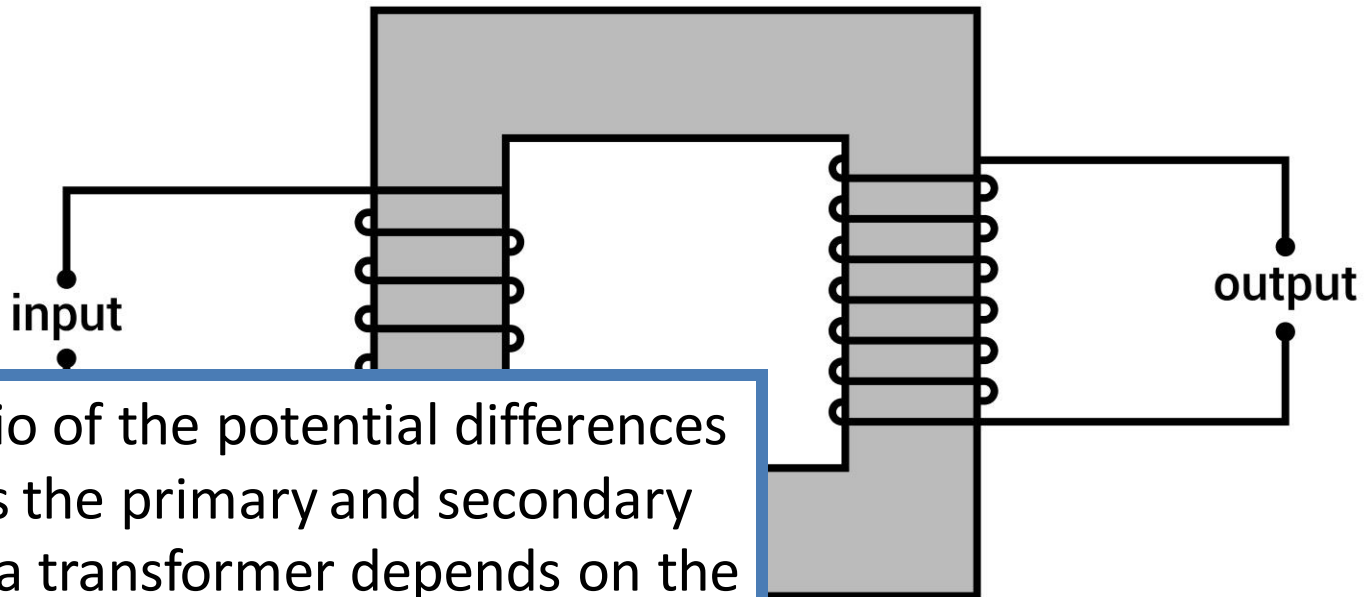
Think

Pair

Share

What are transformers?

A basic transformer consists of:



The ratio of the potential differences across the primary and secondary coils of a transformer depends on the ratio of the number of turns on each coil.

CS/F

CS/H

SS/F

SS/H

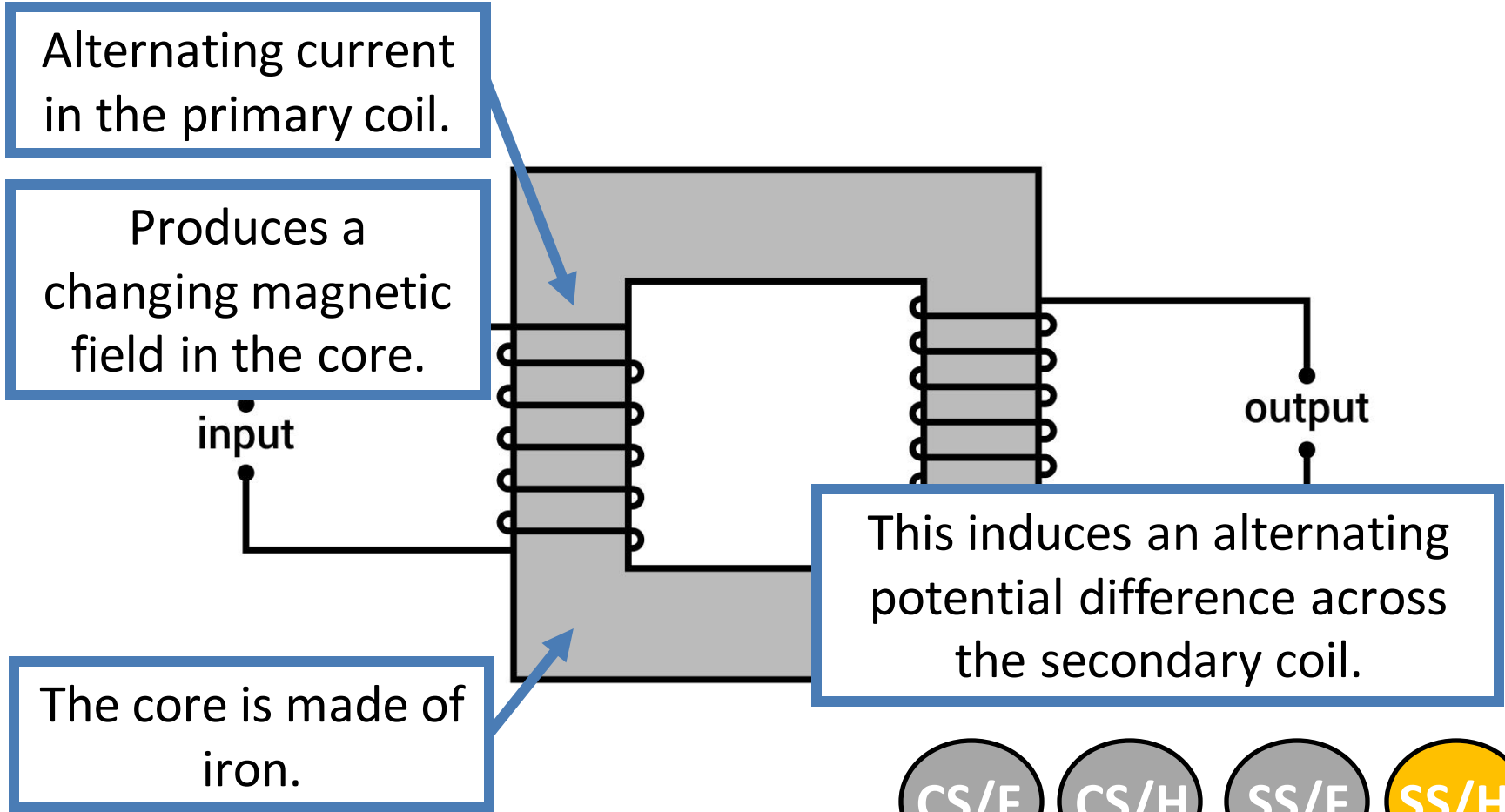
7.3.4 Transformers

Think

Pair

Share

How do transformers work?



CS/F

CS/H

SS/F

SS/H

7.3.4 Transformers

Think

Pair

Share

What are transformers?

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$



Potential Difference

V

In a step up transformer $V_s > V_p$

In a step down transformer $V_s < V_p$

If transformers were 100% efficient, the electrical power output would equal the electrical power input.

CS/F

CS/H

SS/F

SS/H

7.3.4 Transformers

Think

Pair

Share

What are transformers?

$$V_s \times I_s = V_p \times I_p$$

The power output of the secondary coil.

Power input and output is measured in watts W.

The power input of the primary coil.

